$$pH = -\log[H_3O^+]$$

calculate pH of 10ml of 0·025M HNO_3 if 20ml of water added to it

$\frac{1}{3}$ of $0{\cdot}025 = 8{\cdot}33 \times 10^{-3}$

$pH = -\log[8{\cdot}33 \times 10^{-3}]$

ans: $pH = 2{\cdot}08$

$$K_w = 1\times10^{-14} = [OH^-][H_3O^+]$$

calculate $[OH^-]$ of the soln

$$[OH^-] = \frac{1\times10^{-14}}{8{\cdot}33\times10^{-3}} = 1{\cdot}20 \times 10^{-12}$$

$MgCl_2$
$Cl^- > Mg^{2+} > H^+ = OH^-$

NH_4Cl
$Cl^- = NH_4^+ > H_3O^+ = NH_3 > OH^-$

$NaOH$
$OH^- = Na^+ > H_3O^+$

$Ca(OH)_2$
$OH^- > Ca^{2+} > H_3O^+$

HCl
$H_3O^+ = Cl^- > OH^-$

CH_3COOH
$CH_3COOH > H_3O^+ = CH_3COO^- > OH^-$

NH_3
$NH_3 > OH^- = NH_4^+ > H_3O^+$

$C_{12}H_{22}O_{11}$
$C_{12}H_{22}O_{11} > H^+ = OH^-$

$$K_a = \frac{[H_3O^+][A^-]}{[HA]}$$

acid dissociation constant

$$pK_a = -\log K_a$$

Calculate the pH if 20ml of water is added to 20ml of 0·05M ethanoic acid

$K_a(CH_3COOH) = 1{\cdot}78 \times 10^{-5}$

conc $\frac{0{\cdot}05}{2} = 0{\cdot}025M$

$$CH_3COOH + H_2O \rightleftharpoons CH_3COO^- + H_3O^+$$

$$K_a = \frac{[CH_3COO^-][H_3O^+]}{[CH_3COOH]}$$

$$1{\cdot}78\times10^{-5} = \frac{x . x}{0{\cdot}025}$$

$$(1{\cdot}78\times10^{-5})\times(0{\cdot}025) = x^2$$

$$6{\cdot}67\times10^{-4} = x$$

conc of H_3O^+

$$pH = -\log[H_3O^+]$$
$$= -\log(6{\cdot}67\times10^{-4})$$
$$pH = 3{\cdot}18$$

Ka value describes the extent that the acid will react with water. CH_3COOH is a weak acid so the Ka value is low, indicating that it is only slightly reactive with water, so Ka must be used in the calculation

$$K_b = \frac{[BH^+][OH^-]}{[B]}$$

$$K_b = \frac{K_w}{K_a}$$

calculate the pH of a 0·15M solution of NH_3

$K_a(NH_4^+) = 5{\cdot}75 \times 10^{-10}$

$$K_b = \frac{K_w}{K_a} = \frac{(1\times10^{-14})}{(5{\cdot}75\times10^{-10})}$$

$$K_b = 1{\cdot}74 \times 10^{-5}$$

$$K_b = \frac{[NH_4^+][OH^-]}{[NH_3]}$$

$$1{\cdot}74\times10^{-5} = \frac{x . x}{0{\cdot}15}$$

$$(1{\cdot}74\times10^{-5})(0{\cdot}15) = x^2$$

$$1{\cdot}62\times10^{-3} = x$$

conc of OH^-

$$K_w = [OH^-][H_3O^+]$$

$$\frac{1\times10^{-14}}{1{\cdot}62\times10^{-3}} = [H_3O^+]$$

$$6{\cdot}17\times10^{-12} = [H_3O^+]$$

$$pH = -\log\ 6{\cdot}17\times10^{-12})$$

$$pH = 11{\cdot}2$$